Reality Checking USEPA's Nutrient Loading Tool

USEPA has an online tool that allows any user to track nutrient loading from point source dischargers [HYPERLINK "http://cfpub.epa.gov/dmr/usersguide.cfm"]. The tool is linked to ICIS, the effluent data tracking system. The tool can model nutrient concentrations in effluents by class of facility even if no nitrogen or phosphorus data has been entered into ICIS for a given facility. Illinois EPA became aware of this tool when a USEPA user of the tool had a question about a very high phosphorus load coming from an IL oil refinery. When she contacted IEPA, I was provided with an output spreadsheet from the tool that gave P loadings from all IL dischargers in 2009. I noted that many of the P loads from individual facilities seemed very high. I had several conversations with the USEPA staff person who developed the tool (Carey Johnston). I then began a fact-checking exercise described as follows.

Beginning with the USEPA tool-generated spreadsheet of phosphorus loading from IL facilities for 2009, I simplified the spreadsheet by deleting columns. The simplified spreadsheet is identified in attached files as IL_2009phosphorus.xlsx. The columns in this spreadsheet begin with the permit #, name, city and county of the facility. Then the design average flow, actual average flow, total pounds pollutant (phosphorus) per year, total annual flow and average P concentration are given for the facility. Finally, the last two columns are the data source for the concentration data and the data source for the flow data. Since most IL facilities do not report P in DMRs, most facilities had modeled P concentrations given (only four of the top 100 USEPA list P load facilities had projections based on DMR data).

Several IEPA efforts to obtain actual (rather than modeled) P concentration data were begun. One was to contact the Illinois Association of Wastewater Agencies (IAWA) to obtain its cooperation in obtaining P data from its member facilities. These tend to be the largest municipal sewage treatment plant facilities in the state. Many but not all IAWA member facilities sent me effluent P data collected from the last five years. Not all responding facilities had data going back this far. This data is often not required to be reported and for many facilities, if it is reported it is a monitoring-only condition (rather than a permit limit) and thus is not entered into the ICIS data system. Along with the P concentration data, I was provided (or in some cases obtained from DMRs) flow data. Usually monthly flow data could then be paired with a monthly average P concentration. I could then easily determine the monthly load of P and from this, an annual average P load (in pounds). I was provided data from 38 facilities which represent an estimated total of 80 to 85% of the total P load from municipal facilities in the state. All of the very large facilities reported P data, thus accounting for this large majority of municipal sewage treatment plant flow and therefore P loading.

Another effort was to trace down the P concentration in power plant discharges. Many of the largest P load dischargers in the USEPA tool-driven exercise are power plants. Sources of P in power plant effluents are treatment additives, namely corrosion inhibitors and ash pond effluents. Neither of these sources contains very high concentrations. Through looking through records for approved additives that contain P, acknowledging ash pond discharges and in some cases calling power plant operators to inquire about P addition at their plants, a reasonable idea of the P concentration due to P addition at the power plant (as opposed to P in cooling water drawn into the plant with natural surface water) was obtained. An effort was made to be overly conservative

when assigning a P concentration to a power plant effluent. Nearly all power plants report cooling water discharge flow on DMRs and these flows were assigned P concentrations conservatively, meaning that a high estimate for the concentration was used. More detailed study will most likely bring these estimates down. Some power plants add no phosphorus.

Effort was also made to estimate P contributions from facilities that were neither power plants nor municipal sewage treatment plants. This includes facilities like fertilizer plants, high rise building chiller cooling water discharges, grain storage and processing and other facilities. A file search was conducted for each to determine if cooling water contained additives, process water was discharged, etc., and an estimate was made for P concentration. Records also were checked for flow values for all facilities because often the flow given in the USEPA spreadsheet was wrong.

If no information was available to me on P concentrations, I used the values given in the USEPA spreadsheet. However, I recalculated the annual P load using a formula for converting concentration and flow volume to pounds. I could not determine how USEPA determined annual P load and in fact it seems that USEPA uses several different formulas. The IEPA formula is: P concentration in mg/L X flow in MGD X 8.34 X 365 (days in a year) = annual P load in pounds. The 8.34 value converts mg/L and effluent volume to pounds. Sometimes my calculation of P load resulted in a higher annual pounds value than the USEPA tool, but usually my calculation was lower, sometimes much lower. I also corrected average facility flow when necessary.

A new spreadsheet was produced to compare the results of IEPA calculations of annual P loading to those of the USEPA tool spreadsheet. Included in this spreadsheet, attached as phoscorrected.xlsx, are the top 100 highest annual P load facilities as found in the USEPA tool output. Also included are data from any facilities (n=8) which IEPA obtained P data from in the IAWA data search that were outside the top 100 on the original USEPA list. The first column of the IEPA 'corrected' spreadsheet is the number corresponding to the rank of the highest P load facilities in the USEPA spreadsheet. Then comes the permit #, name of facility, design average flow, actual average flow, average P concentration, annual average P loading and years of P data used to compute concentration. The last column is the annual P loading determined from the USEPA spreadsheet. Two symbols are used in the column showing the number of years of P data that were available. A single asterisk means that no extensive P database, such as present at the IAWA facilities was available, however, the best attempt at determining P concentration was made based on our knowledge of the facility. Three asterisks means that no P concentration data was available and that the values on the USEPA spreadsheet were used with the IEPA formula to calculate annual P load. A numeric value in this column is the number of years for which P concentration was available for the effluent.

One facility initially identified by USEPA as a substantial phosphorus discharger had an annual load that was found to be grossly overestimated. The single highest P load from the USEPA spreadsheet (the item USEPA initially contacted us about) is the Phillips 66 refinery. It was discovered that ICIS had a units problem for the reported DMR phosphorus. This was corrected and the annual P load from the refinery was greatly reduced. The annual load value in the USEPA spreadsheet exceeded the total from all other facilities in the state, so this is a very

significant change. It is interesting to note that I did not find an error related to our ICIS system for any other facility.

With the Phillips 66 data removed, the USEPA tool generated spreadsheet gives a total annual P load for all facilities as **33,959,409** pounds. The top 100 facilities discharge 28,890,836 pounds and the remaining 1560 facilities discharge 5,067,573 pounds according to USEPA. The corrected data shows that 108 facilities, which includes all the USEPA top 100, discharge a total annual P of 12,538,417 pounds. Even if no corrections are appropriate for the remaining 1560 facilities, the corrected total is **17,605,990** pounds annually. This is approximately one-half of the USEPA total.

Obviously, the utility of the USEPA tool is in question. The tool does not allow an accurate estimation of point source phosphorus loading in Illinois. The overestimation is probably at about twice what is actually discharged. Illinois will work with USEPA in any way possible to correct the errors inherent in the tool. It will be interesting to find out if this tool also overestimates other parameters or overestimates the phosphorus or other parameters in the point source discharges from other states.